Printed Pages:03 **Sub Code:KCA 205**

Paper Id: 238189 **Roll No.** | | | | | | | | | | |

MCA
(SEM II) THEORY EXAMINATION 2022-23
DATA STRUCTURES& ANALYSIS OF ALGORITHMS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

(a) Describe the *Big Oh* notation.

(b) Differentiate between array and linked list.

(c) Let J an K be integers and suppose Q(J,K) is recursively defined as

$$Q(J,K) = \begin{cases} 5 & \text{if } J<K \\ Q(J-K,K+3)+J & \text{if } J>=K \end{cases}$$

Find Q(4,7).

(d) Consider the following linear queue capable of accommodating maximum five elements. Front = 2 Rear = 4 Queue _ L, M, N, _
Compute following operations
(i)Add O (ii) Add P (iii) Delete two letters (iv) Add Q, R

(e) What do you mean by non-comparison sort? List two non-comparison sort algorithms.

(f) Apply selection sort algorithm on given data to sort in ascending order:-
5,8,6,2,1,3

(g) Discuss the concept of inorder "successor" and inorder “predecessor” in Binary Search Tree.

(h) Give static and dynamic memory representation of binary tree

(i) How dynamic programming approach is better from recursive programming approach

(j) What is the role of a negative cycle, while you are computing the shortest path in the graph

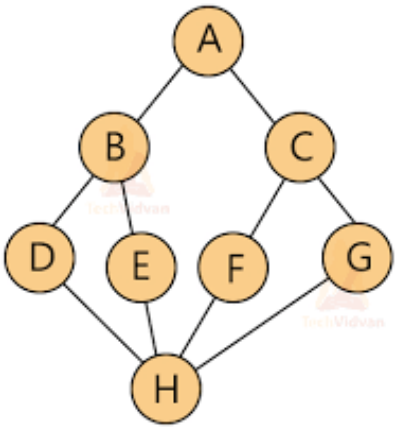
SECTION B

2. Attempt any *three* of the following: **10x3=30**

(a) Discuss how two-dimensional array can be stored in the memory and **compute** the following. An array Arr[50][100] is stored in the memory along the row major with each element occupying 4 bytes of memory. **Estimate** the address of the location Arr[20][50], if the base address 1000.

(b) Write down algorithm to evaluate postfix expression and also evaluate given postfix expression using the algorithm
10, 7 + 30, 6 / ∗ 8 –

(c) Discuss various methods to represent graph in the memory, Also write down algorithm to do DFS in the graph. Apply that algorithm on given graph to compute DFS Tree



(d) What is AVL tree? What is balancing factor? Explain balancing method of AVL tree with all possible cases with suitable example

(e) How Strassen's matrix multiplication provide better time complexity over classical matrix multiplication algorithm. Apply the Strassen's algorithm method on the following matrix $\begin{bmatrix}1 & 5\\7 & 3\end{bmatrix}$ and $\begin{bmatrix}8 & 2\\6 & 4\end{bmatrix}$.

SECTION C

3. Attempt any *one* part of the following: 10x1=10

(a) How to represent followings linked lists in memory provide their self-referential structure and proper diagram

(i) Single linear Linked List
(ii) Doubly linear Linked list
(iii) Circular Doubly Linked List
(iv) Header Linked List

(b) Give an algorithm or C function to perform following operations on single linear linked list

(i) Insert a node after a given node
(ii) Delete a node from end

4. Attempt any *one* part of the following: 10x1=10

(a) What do you understand by hashing? What are the different hashing techniques? Discuss different techniques to resolve collision once it is occurred during hashing.

(b) Write a 'C' program to implement two stacks in a single array. One stack will grow from one end of the array and second stack will grow from the other end of the array. User need to implement following functions

(i) Push in specific stack
(ii) Pop from Specific stack
(iii) Handing overflow and underflow cases

5. Attempt any *one* part of the following: 10x1=10

(a) Write heap sort algorithm and draw the max-heap only for following data
1,2,3,4,5,6,7,8,9,10

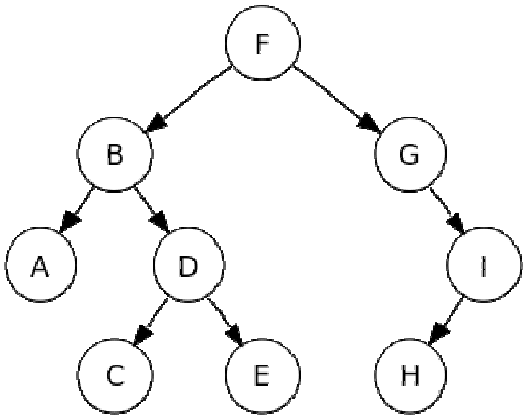
(b) Write down Quick Sort Algorithm and apply it on following data to sort it.
5,8,7,6,3,4,1,9,2,10

6. Attempt any *one* part of the following: 10x1=10

(a) Write down recursive algorithm to insert a node in binary search tree. And apply that algorithm to construct BST with given data.

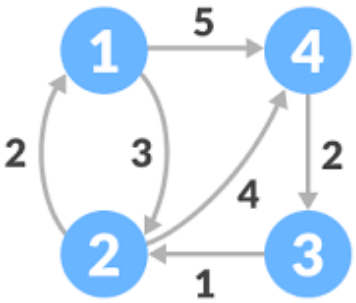
8,5,12,67,43,23,6,3,2,8,24,21,20

(b) Demonstratethe traversal of the following tree in Pre-Order, Post-Order and In-Order. Also write recursive algorithms of three traversals.



7. Attempt any *one* part of the following: 10x1=10

(a) Write down algorithm of Floyd-Warshall to compute all pair shortest path with in the graph. Also apply it on following graph



(b) Discuss the applications of longest common subsequence(LCS). Determine the LCS of <1.0,0,1,0,1,0,1> and < 0,1,0,1,1,0,1,1,0>